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PRODUCERS' PRICES FOR INDUSTRIAL GOODS

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I. INTRODUCTION

1. This paper will confine itself to the collection of data at producers' prices in the ISIC groups 2 and 3, namely mining and manufacturing and covering only the domestic producers. The paragraphs that follow are extracts from the "Manual on Producers' Price Indices for Industrial Goods" prepared by the United Nations Statistical Office. This manual is still under the process of production and will be circulated to all the statistical offices as soon as it has been completed. It describes how price statistics should be collected and processed to construct indices for groups of commodities and for the output of various mining and manufacturing activities.

2. For our purpose of discussion, the secretariat thought it better to extract the main sections of the manual that highlight the problems of data collection. These include selection and specification of items, selection of reporting units, and price observation. For more details covering a wide range of topics, refer to the manual as soon as available.

II. DEFINITION OF PRODUCERS' PRICES

3. This paper deals with the procedures which may be used to measure the prices at which producers in mining and manufacturing activities sell their output. "Producers' prices" differ from "purchasers' prices" because they exclude the trade margins and transport costs which may be incurred in delivering the output from the producer to the purchaser.

4. As used in this paper, the term "producers' prices" should not be confused with "producers' values" as defined in A System of National Accounts (SNA). "Producers' values" in the SNA refer to the values of commodities at the establishment of the producer including all commodity taxes (such as sales taxes or excise duties) levied on that output. When these commodity taxes are excluded, output, in SNA terminology, is said to be valued at "approximate basic values". The term "producers' prices" as used in this paper may refer to goods valued on either basis - i.e. excluding commodity taxes.

III. SELECTION AND SPECIFICATION OF ITEMS

5. This section describes the procedures by which commodities and items within commodities may be selected for periodic price reporting. For the most part the selection of commodities is discussed without reference to the selection of reportingunits - i.e., the firms, establishments, or enterprises which produce them. This distinction is somewhat artificial since in most cases the choice of commodities to be priced and the identification of respondents are not carried out separately. Logically however, it is clear that two distinct issues are involved, ant that at least conceptually the selection of commodities should precede the choice of reporting units.

A. Selection of commodities

6. The starting point for the selection of the itmes to be priced is the compilation of a list of all commodities produced in the country by establishments engaged in mining, quarrying, and manufacturing. The list should show commodities inasmuch detail as possible and must give the value of output or sales of each goods during a recent year. If possible the list will also give information on the number of producers and where they are located, the growth in sales in recent periods, and the price dispersion or range for each commodity. A census of production covering all industrial

establishments is clearly the most suitable source for such a list. In practice, however, relatively few countries have ever undertaken a comprehensive survey of this kind.

7. An alternative approach in these circumstances is to start with a list of establishments classified by kind of activity and showing total estimated sales or output of each establishment. In most countries establishment lists of this kind will already have been drawn up by the statistical office since they are a basic tool for collecting most kinds of economic statistics. An establishment list gives only indirect and very aggregative information on commodities. It may show for example that there are a certain number of establishments in major group 341 of ISIC - "manufacture of paper and paper products" - but it would not show the large variety of different commodities produced by establishments, including characteristic products ranging from wood pulp and paper board to envelopes and wallpaper, as well as secondary non-characteristic commodities like tar-coated paper or printed cards and stationery. An establishment list willtherefore have to be supplemented by commodity information from other sources. These may include export statistics, information from trade associations, or data on household consumption. Clearly it will also be essential to make direct contracts with at least the larger establishments on the list.

8. When the first stage of the selection process is completed (how the selection is made is discussed shortly) the result should be a list of commodities to be priced, related non-selected commodities, and weights expressed either as money amounts or proportions. Every commodity on the list must be accounted for - that is it must have been chosen as a commodity to be priced, or its weight must have been assigned to a related item selected for pricing. THis stage in the selection process might conclude as in Table 3.1. The 8-digit commodity code shown in this table is used purely for purposes of illustration, and many countries would find it neither feasible nor necessary to use a classification as detailed as this.

Table 3.1 Commodities to be priced

Code	Latest value	Selected for pricing	Value weight
XXXX 66--	500		
661-	240		
6611	100		
6612	80	X	240
6613	60		
662-	60		
6621	25		
6622	35	X	60
663-	200		
6631	55		
6632	8		
6633	7		
6634	125	X	200
6635	5		

9. In this example the simplest possible approach has been taken. One eight digit commodity has been selected to represent each seven digit group. However, it will generally be possible to make the code structure more suitable for price collection purposes. Commodity codes like the ICGS and most national classifications have been established for the collection of production and industry information and may not be well designed for the selection of commodities to be priced in an ongoing monthly or quarterly price survey.

How many price reports per commodity ?

10. In designing the price collection programme the statistician faces the issue of whether to spread the observations over a large number of commodities with each thinly reported or to select a limited number of commodities and collect many observations for each one. The extreme solutions to the problem would be to use the available resources to collect a single observation for every eight digit number of commodity or to collect hundreds of observations for a small number of commodities.

11. Obviously neither of these extremes is to be recommended. The first approach would give acceptable price indices for total manufacturing and maybe the next level of disaggregation but not for individual commodities. The other extreme would produce high quality price indexes for a small number of commodities but would give poor quality estimates at high levels of aggregation. In the first case there is redundancy in the number of commodities collected. In the latter case there is redundancy in the number of observations for the few commodities for which prices are collected. The statistician must select a course within these extremes by a process which minimizes variances within established goals given the resources available for conducting the survey. If all the information on variances of price changes were available the process would be one of meeting target variances for commodities and the various levels of aggregation.

12. Because of limited knowledge about the variance of price-changes, trial and error inevitably plays a part in setting up the price collection programme. However, once the survey has been running for a year or two, the statistician will be in a better position to determine whether more or less observations are needed for particular commodities. If there are six price reports for a given item and all show a very similar price movement the statistician might consider dropping some of them so as to increase the number of price reports for an item which shows greater variation in price changes. 1/

1/ In addition to a simple inspection of the price-data, the technique of step-wise regression can be used to determine whether there is "redundancy" in the price data. A stepwise regression analysis shows how many observations are required to estimate the actually observed price index for a given commodity with a correlation coefficient of 1.0. A description of such an analysis as applied to the U.S. Wholesale Price Index is given in the Wholesale Price Index: Review and Evaluation, op.cit.

Selection of specific items within commodities

13. The next stage in planning the over-all programmes will be to specify within the eight digit code the specific items to be priced. For example, within the commodity "men's shirts", which particular type (size, colour, sleeve-length, material, etc.) is to be selected for pricing ? At this stage a basic strategy issue is encountered. The specification may be drawn up in great detail or it may be prepared on a relatively broad basis. There are advantages and disadvantages in each approach.

14. If the specifications are highly detailed - e.g. men's shirts with collar, long-sleeved, plain white, all cotton, non-shrink, non-crush - the statisticial office may have better control of the process and the collected prices may be sufficiently homogeneous so that actual prices can be published. However, extremely detailed specifications may result in difficulties in collecting price observations since the product may not be made month after month. Furthermore, for some producers a very narrowly specified commodity may be incidental to its production of the eight digit commodity and unrepresentative.

15. A broadly specified commodity on the other hand is more flexible and permits some adaptation to the circumstances of individual respondents. Then reporting arrangements must be made with each enterprise so that sub-specifications within the specifications are determined. One respondent for example, may report for white shirts while another reports for striped shirts, or a firm producing low priced shirts reports their prices while a manufacturer of a high priced line of shirts reports for them. Obviously the statistical office has a more complicated task of controlling the operation because it must ascertain that reporting units continue to price the identical items month after month. A further drawback is that it is not feasible to publish the actual average price in such situations since the prices collected cover a range of specifications within a commodity code.

16. In general, however, the advantages of broad specifications will usually outweigh the disadvantages, and it is probably the superior course for commodities for which it is not intended to publish average prices. It introduces greater flexibility in the programme, probably creates greater representativeness of reported prices and is likely to increase the number of usable observations. Furhtermore establishing the specifications is not a one time operation. The specifications must be continuously reviewed, revised and updated as commodities undergo change.

17. An important question which arises at this stage is how many items each respondent should be asked to report. From an efficiency point of view one would obviously wish to collect as many observations as possible from a firm. Once all the overheads and collection costs are taken into account, collecting and compiling a few more observations adds only marginally to the processing costs. However, public relations and respondent burden must also be considered and some limits imposed. A firm requested to report thirty price observations each month may be unwilling to co-operate but would do so if asked to report seven or eight observations.

18. To avoid imposing too great a reporting burden on respondents while at the same time keeping costs to a minimum it is desirable to set upper and lower limits on the number of price reports from each respondent. A typical rule would be that no respondent is asked to report more than a dozen prices nor less than three. These limits might occasionally be exceeded if particular respondents are exceptionally co-operative or especially unhelpful.

19. For the actual selection of items sampling or non-sampling procedures may be used. These will be considered separately.

Sampling selection of items

20. If random sampling procedures are adopted, the rules should ensure that items over a fixed value of sales or output are selected with certainty, while the remaining products are picked on a random probability basis. In a full sampling structure each commodity selected within a firm for pricing monthly will have a weight associated with it. The weight will be a composite of the probability of selection of the enterprise and the probability of selection of the commodity. The specific item to be priced will be the specification within the commodity.

21. A sampling scheme will require periodic maintenance or updating. This may be needed to identify new enterprises (births) but also for cases where a firm has expanded its production line to new products which should be given a chance of selection. This, of course, must be part of a comprehensive plan so that no bias is permitted to creep into the sampling or estimation structure.

Non-sampling selection of items

22. The advantage of random sampling is that it is an impartial way of selecting the items to be priced, and if a non-sampling approach is used it is important that the selection of items is based on some set of formal rules. These rules should prevent the omission of items merely because it is likely that it will be difficult to collect comparable prices from one period to another, and the rules should also avoid allowing the respondent to have too much influence in the selection process. Even if it is assumed that no harm is intended the potential respondent will be influenced in ways that do not conform with accepted statistical standards. The respondent may suggest the reporting of items for which prices do not change or do not change inordinately. The aim is to choose items which account for a substantial proportion of the respondent's turnover, which have been in production for a reasonably long period (and which are not about to be discontinued in the near future), and which are representative of the bulk of the respondent's output.

IV. SELECTION OF REPORTING UNITS

23. The previous section dealt with the specification of commodities and the selection of particular items for regular price reporting. This section will discuss how the actual respondents should be chosen. The main issues dealt with are the definition of reporting units, the relative merits of sample versus non-sampling selection, and how best to secure the co-operation of prospective respondents.

Identifying the reporting unit

24. There are two parties to every sales transaction and each party will ordinarily have knowledge of the price and other terms of the transaction. It would appear therfore that one might define the rpeorting unit for collecting producers' prices as either the producer or purchaser. Traditionally statisticians have collected price observations from the seller, probably because for each seller there are hundreds or thousands of purchasers. Each producer of textiles for example, may sell to hundreds of apparel and furniture producers and to many wholesalers. Thus, the producer may be thought of as covering many more transactions for the commodity. In areas where discounting and negotiating arise, however, true transaction prices may be easier to collect from purchasers.

25. It would seem difficult to collect prices from the purchaser on a recurring and comprehensive basis since it is unlikely that the kind of refined processing needed to remove purchases from wholesalers, from foreign supplies, etc. will be feasible. There may be some commodities where collecting prices from purchasers is preferable because producers are unable or unwilling to provide real transaction prices, but the recommendation of this manual is that to the extent possible the price observations should be collected from producers.

26. Having decided to collect prices from the producer, it is now necessary to examine the kind of producing unit which should be asked to submit the prices reports. If all producing units are enterprises or firms with one establishment each, no problems arise. The enterprise and the establishment have the same boundaries and if it falls into the survey there is only one possible reporting unit. An enterprise, however, may consist of many establishments and these may be organized within the enterprise in a variety of ways. Standing between the establishment and the enterprise may be legal subsidiaries or division.

27. For our purpose we shall call such intermediate levels of organization divisions. Generally, divisions of an enterprise will have the responsibility of managing the production and sale of groups of commodities. Thus, an enterprise may have a chemical division and a cement division, or a household applicances division and a machinery division. Further, the division may consist of several establishments engaged both in manufacturing and in related kinds of activities such as sales, warehousing or the purchasing of materials. Large enterprises of this type will generally be included in the price surveys, and the question arises as to which organizational unit within the enterprise should be asked to submit the price reports.

28. The statistical office may have no options; the enterprise may insist on some way of reporting. To the extent that the statistician does have the choice, it is clear that reports should be sought from the unit which concludes the sales. In practice this unit will normally be located at the headquarters of the company or division. The establishment of a large multi-establishment enterprise will generally not be a good reporting unit for price information. Within such an enterprise the establishment is frequently treated simply as a production unit and does not have access to all of the latest pricing information. Discounts from a list price may not be known at the establishment level, and where both order prices and

delivery prices are sought they may be known only at the enterprise or division level. While the establishment is probably the best unit for reporting employment, wage payments, quantities produced, energy consumption or other physical measures connected with production, the enterprise or division is the sales and financial centre and is the preferred unit for price reporting.

Selection of reporting units

29. In many countries, there may be only one or two producers for many commodities which have been selected for pricing. This is often the case in small developing countries, because the market cannot support more than one producer using modern mass production techniques. In consequence, it is common to find countries with only one cement factory, textile mill, shoe factory, vehicle assembly plant, cigarette factory, or brewery, and in these circumstances the selection of the commodity automatically involves selection of the reporting unit. Similarly where there are a small number of producers (say 3 or less) price reports should probably be sought from all of them unless market shares are very unequal in which case the smallest producer might be omitted.

30. In what is probably the normal situation however, there will be several producers of the commodities chosen for pricing. In selecting prospective respondents the statistician may choose a sampling or non-sampling approach; these will be separately considered.

Sample selection of units

31. The statistician confronted with any measurement problem must initially consider the possibility of installing a rigorous probability sample. In this context probability sampling means the selection of a sample panel from a universe of reporting units in which each unit has a known chance of selection. In this section some comments on the features of a sample design for measuring price changes in manufacturing and mining are offered.

32. A probability sample permits the measurement of the quality of the survey results through estimates of the variance or sampling error. The quality of results in this context relates only to the chance of a difference between the results obtained from the sampled observations and the result that would have been obtained in a complete enumeration of all reporting units in the universe. The use of a probability sample does not permit the measurement or control of errors arising from non-response, inaccurate reports, obsolete weight proporations, unrepresentativeness of the commodities priced, or any other "non-smpling" source.

33. The first requirement of the sampling process is to define the universe or population and to identify all units in the universe. The universe list must be continously updated by adding new entrants (or "births") early in their lives so that they have a chance of selection. Disposition of "deaths" is automatic. Identification of births must be rigorous and relate only to true births since a mere change of name or reorganization of an existing firm is not to be treated as a birth. In practice, the continous review and updating of the universe list is a costly and difficult business.

34. It is a well known principle of sampling that stratification into segments for which the dispersion of price changes are lower than the over-all dispersion tends to increase the efficiency of the sample by reducing variance. The type of stratification to be undertaken will depend upon the specific circumstances of each country. It may sometimes be desirable to stratify by geographic region or province. Certainly this will always be required in a survey of retail prices. The need is less obvious in the case of manufacturing but may be warranted in some industries where distribution of output is in a limited geographic area and prices may be responsive to cost and demand conditions which are local in character. Producers of dairy products and bread, for example, might be stratified by province or even smaller regions before sample selection of reporting units.

35. The sample design should ensure that all units above a certain size are included. The remaining units should be sampled with probability of selection proportionate to size ("PPS"). This is a well-known technique which is described in most standard texts on sampling. The alternative approach of setting broad strata such as those with value of sales of 1 million to 5 million, 5 million to 10 million, etc., will result in units within each stratum having an equal chance of selection and when selected an equal inflation weight. In a PPS sample design a unit with 5 million of sales will have roughly a five times greater change of selection than a unit with 1 million in sales. Further, the unit falling into the sample on a PPS selection would have an inflation factor inverse to its size, an additional improvement over broad stratum sampling.

Non-sampling selection of units

36. It will often be necessary or even desirable to do without probability sampling. A country may have no practical way of determining the universe in advance, or the cost of installing and administering a proability sample may be judged too high. There are clearly high costs involved in the design, selection process, control and administration of a probability sample for collecting price observations. Furthermore, price indices are in an area of statistics where the risks in not having a probability sample are probably the lowest. This is because the potential diversity of the change in prices charged by various producers of a given commodity over many time periods is relatively low. Stated another way price changes for a given product are more highly correlated than for other variables such as sales, capital expenditures, inventories, etc. Price may be viewed as a function of direct and indirect input cost, profit margin, and productivity and price changes from one period to another may be factored into changes in costs, profit margin and productivity. A number of producers of the same product will be subject to similar changes in costs of direct and indirect inputs, the major component of the change in price. Similarly while one firm may gain an advantage in productivity for short periods this will generally be rectified as new technologies spread or inefficient firms leave the industry. While profit margin and the change in such margins may vary they are a small component of price. Thus the price of a given product which, for several producers, cluster around 100 at a point in time may be expected to cluster around, say, 200 after a number of years. There cannot be wide divergences in the price change for the same product.

37. If a non-sampling approach is decided on, the selection procedure should take account of the way in which the observations for a specified commodity are to be combined. More specifically it should depend on whether each observation is to be weighted by each producer's estimated sales. Consider the following hypothetical distribution of sales of a particular commodity among 8 producers.

Producer	Share of sales
A	.40
B	.30
C	.10
D	.07
E	.06
F	.05
G	.01
H	.01

38. Assume that the complete universe is known and that it has been decided to select 4 reporting units from among the eight. If the four observations are to be averaged without weighting then the best procedure would be to select the 4 largest producers A, B. C, and D. This will ensure that the average price is calculated from the most commonly produced goods. On the other hand, if it is decided to weight the price observations by each producer's sales share, a better procedure would be to select producers A and B plus 2 others from C, D, E and F. Producers G and H would be ignored in a non-sampling approach. They are simply too small and it would be a waste of resources to include them in the survey. The two selected from the 4 middle-sized producers could be assumed to be representative of all producers other than A and B, and the sales shares of the 4 non-selected producers would be distributed between them as weights.

39. However, it will often be the case that the complete universe of producers of the commodity is not known. The larger firms will generally be known and the list of smaller producers will be incomplete. In such cases the safest course to follow will be to collect price observations from the four largest known producers. It is however important in such cases to update lists of producers and identify new producers or small firms that increase their sales volume and become large.

V. PRICE OBSERVATION

40. The following discussion deals with the various conditions of sale relating to transactions for the specified commodity. A series of conditions are discussed and the ways in which the statistical office may proceed are reviewed. The concern is with delivery prices as opposed to order prices: references to a commodity's price in a particular period are to the prices paid for deliveries made in that period and not for orders received during that period (some of which may be for future delivery). It should also be noted that the discussion here proceeds on the assumption that the price observations are being collected from the seller; as mentioned earlier this is the traditional way of collecting data on producers' prices and is the approach recommeded here.

Intra-company transactions

41. In large companies or enterprises there may be a substantial volume of sales between the various production units. Goods produced by one establishment may serve as input for another establishment within the same company. These intra-company transactions, however, may not be recorded in a way that reflects a true price. The transaction may be made in the books of the company at direct costs or at direct plus overhead costs, excluding a profit margin. Or the "price" may be recorded at some nominal amount. There may even be some tax advantage to the firm in valuing the transfer below or even above the probable market price. A term often applied in such situations is that internal transfers may not be recorded at "arms length prices".

42. If the commodities involved in these intra-company transactions are also sold to other firms in reasonable volume, the statistical office may decide to include them in the price survey. It should however be careful to collect only the prices pertaining to sales with external customers; prices relating to intra-company transactions should be avoided.

Class of customer

43. The producer may be selling the commodity to be priced to several different classes of customers such as manufacturers, wholesalers, small retailers, discout stores, construction firms, foreigners, government, or non-profit institutions, and may charge different prices to different classes of customers. In some instances different prices arise because different costs are associated with sales to each class of customer for the identical physical commodity. Or a lower price may be charged to a customer where there is no risk and no delay of receiving payment as compared with some other customer class.

44. The correct procedure in these circumstances is to treat each class of customer separately in collection and tabulation of price indexes. Where the price is different, the price changes may also not be uniform so that muddling prices recorded in, say, sales to retailers and sales to government may yield biased results. Commodities which are physically identical are in effect to be treated as different commodities when they are sold to different classes of customers.

Volume of the sale

45. Even within one class of customer price differences may arise because of the volume of a sale. A purchaser of a very large volume will receive a lower price than does the small volume purchaser. The economic rational for this is that the unit costs for the large volume are lower - i.e., the producer may actually earn the same profit per unit of output on a low price charged on a large-volume sale as with a high price on a small-volume sale. There are many ways in which this might occur. A long production run in some industries is more efficient (less cost per unit) than a short production run, or there may simply be some overhead costs which are fixed per order regardless of the size of the order. Hence the statistician should either treat different sales volumes as different commodities or include the most frequent volume of sale as a specification. In one way or another the reported price observations should not be allowed to change because sales of different volumes are being reported.

Multiple delivery orders

46. Purchase contracts are often drawn up for more than one delivery. For example a steel-mill might order several deliveries of coal over a particular period - say 1000 tons to be delivered each month during the next year and a half: the steel-mill itself may agree to supply a fixed amount of steel of a particular grade each month for the next year. In multiple-delivery orders of this kind the unit - prices usually vary according to the period covered. For a given total quantity the price will usually be lower the shorter the over-all delivery period. Higher prices are charged for multiple delivery orders covering longer periods because suppliers try to cover themselves against possible price rises.

47. The statistician should deal with this situation by collecting prices for orders covering the same or very similar periods. Often there are traditional order periods for particular commodities and these should be identified for each price respondent. The price observations for multiple-deliveries should not be allowed to vary because of differences in the length of the deliver period.

Shipping terms

48. The preferred price to be collected is the valuation of goods as they leave the factory, that is, a price which excludes transportation and any other costs associated with the transportation. This is generally referred to as the ex-factory price. There may, however, be cases where trade practices are such that goods are actually sold on the basis of delivered prices. Where this occurs, the statistician will have no option but to accept such price quotations since the records of the firm will be on that basis and there may be no practical way of excluding transportation costs. Responses must be consistent from one reporting period to the next.

Commodity taxes

49. The items being priced will often be subject to commodity taxes, such as excise duties, sales taxes, or value-added taxes. The statistician will then have to decide whether to collect prices including or excluding these taxes. In practice the statistician may have no choice as to which is to be collected because of the way in which records are maintained. Even where there is a choice available to the statistician the requirements for deflation or analysis in different countries may dictate whether to collect prices including or excluding commodity taxes.

50. What is crucial is that the statistical office know what is being reported for each commodity by each respondent. Where possible, a uniform approach should be taken for all commodities. Where this is not possible, a uniform approach should be taken for each commodity. That is, for certain commodities prices may be collected including taxes and excluding taxes for other commodities. When this occurs the statistical offices should adjust one set or the other by "adding" or

"subtracting" the commodity taxes so that the published results are consistent. As a practical matter this merely requires alertness to changes in commodity tax rates for only then will the detailed indexes and aggregations be changed. In rare instances some producers of a commodity will choose to report with commodity taxes included and others prefer to report with the tax excluded. Assuming that neither group can be persuaded to conform then it will be necessary for the statistical office to adjust the data as appropriate.